

## Managed HDSL repeater

### Field of the invention

The present invention is related to Copper line data transmission with HDSL.

### 5 Background of the invention

Transmission with HDSL on copper pairs in the local loop is limited in range by cross talk between pairs in the same cable. To cover the range between telecom operators access points and subscriber locations, the use of transmission  
10 regenerators are necessary.

For maintenance and error detection and recovery, fault isolation on such systems must be achievable. A way of obtaining this is to provide the regenerators with a facility of looping the signal back to the access points.  
15 The regenerators are not easily accessible (dug into the ground), and thus a remote controlling of this looping is needed.

For HDSL (High speed Digital Subscriber Line) transmission systems, a regenerator management is defined as part of the  
20 transmission overhead (EOC) channel between the two endpoints of the line, NT and LT respectively. (References; TS 101135 section 5.7.5 from ETSI and G.991.1 section B5.7.1. from ITU.) The standards define the same set of functions for the regenerator as for the endpoints. Fig. 1  
25 shows the HDSL access line.

In practical systems, the endpoint functionality is expensive, and a limited functionality is very often preferred. The use of the overhead channel for regenerator maintenance also requires that this channel is terminated  
30 and regenerated, and this introduces transmission delay and implementation complexity. A regenerator is powered via the

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transmission lines, and reduction of power consumption, which can be achieved by lower complexity, will extend the distance for remote powering. A pure transmission repeater without overhead channel processing should be a more optimum solution, but it requires another solution of maintenance loop setting.

### Summary of the invention

It is an object of the present invention to provide an arrangement that eliminates the drawbacks described above.

The features defined in the claims enclosed characterize this method.

More specifically, the present invention is related to a regenerator solution by the use of signal repeaters instead of a regenerator as described in the references, and a solution for remote control of switching a transmission loop ON and OFF.

Compared to the known way of HDSL, regenerator management according to the present invention enables the use of signal repeaters which still have the required practical functionality for management.

### Brief description of the drawings

In order to make the invention more readily understandable, the discussion that follows will refer to the accompanying drawings.

Fig. 1 shows a block diagram of an HDSL transmission system.

Fig. 2 shows a block diagram illustrating the activation/deactivation process for an HDSL line.

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Fig. 3 shows a block diagram of an HDSL transmission system with the solution of the present invention implemented.

### Detailed description

When starting up an HDSL transmission system like the one  
 5 in fig. 1, there is an activation sequence where  
 transmission parameters are exchanged between the two  
 endpoints of a transmission line. An HDSL transmission line  
 activation/deactivation is shown in Fig. 2. The LT (Line  
 terminal) is located e.g. at the central office and the NT  
 10 (network terminal) is located on the customer premises.

When a regenerator between LT and NT is at present, the  
 activation/deactivation is between the LT and REG and  
 between the REG and NT. After successful parameter  
 exchange, the transmission is defined to be active and data  
 15 can be transferred between the endpoints. From active  
 state, the transmission can be deactivated. This  
 activation/deactivation process can be detected in the  
 repeater and used to alternate the repeater to send data  
 transparent between the LT and NT or do a loop back of  
 20 transmitted data back to the LT.

According to the present invention, this alternation can be  
 made in such a way that every time there is a  
 deactivation/activation command from LT, a flip-flop in the  
 repeater is being toggled. Flip-flop high can be  
 25 interpreted as loop while flip-flop low is interpreted as  
 transparency. The overhead channel is passing through the  
 repeater between the endpoints LT-NT untouched.

The present invention makes use of one of the free bits in  
 the overhead channel as an origin bit which is set to "1"  
 30 in the upstream direction and "0" in the downstream  
 direction, for thereby making it possible to detect at the  
 access point (LT) whether there is a loop in the repeater  
 or not by looking at the received origin bit. Origin bit

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"0" indicates loop while origin bit "1" indicates data transparency.

As the complete overhead channel is looped back, it is also possible to check the transmission quality by looking at  
5 the standardised HDSL error, monitoring in the same way as with a normal end-to-end connection.

The main advantage of the present invention is that it allows using passive repeaters for regeneration on the transmission line in an HDSL system, and still having the  
10 possibility for remote maintenance and management.

Another advantage is that passive repeaters are much less power consuming than conventional regenerators, and are also less complex and smaller.

Still another advantage of the present invention is that no  
15 data processing needs to be carried out in the repeater. All signals are simply amplified and passed through the repeater. Therefore, the delay introduced in the repeater is limited to a minimum. Also, the fact that the repeater does not need to have any significant software installed,  
20 contributes to minimizing the likelihood of errors, and the probable lifetime will increase.

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